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in scientific reasoning in spite of the Newtonian definition of motion and the definitions given to momentum, energy, force and power. Curiously, I find that even some physicists have not mastered these definitions and still entertain the historical illusion concerning the nature of rest. If my demonstration is studied it will be accepted only in case it does not conflict with some other notion, as that about the nature of relation.

Finally, let me present three other propositions: First, to produce rest in one body it is necessary to transmute one mode of motion into another; second, to produce a new mode of motion it is necessary to transmute a part or the whole of some other mode of motion. Both of these definitions are included in the axiom which I have previously given, that motion cannot be created or destroyed. Third, if motion is not both absolute and relative it does not exist.

J. W. POWELL.

SCIENTIFIC LITERATURE.

Life, Letters and Works of Louis Agassiz. By JULES MARCOU. With Illustrations. Two volumes. New York, Macmillan & Co. 1896. Pp. 302, 318.

Mrs. Agassiz's life of her illustrious husband has always been considered a model of what such a biography should be, full and minute where the matters were important, brief where they were trivial, and composed by elimination rather than agglomeration, so that the effect is massive and interesting from first to last. Mr. Marcou seems to have aimed at muchness of matter rather than excellence of form, and the result is a very different sort of book, realistic and abounding in *traits vifs*, but pervaded by a curious commonness of tone, and by a lack of style rather odd in a Frenchman. In his eagerness to supply every detail of date, place, persons present etc., where events are recounted, too many pages are filled with mere statistical enumeration.

Too much is said of individuals who play subordinate parts in the narrative, and who ought either to have been subordinated still more or made more interesting by becoming more prominent. Any attempt on the part of an outsider to give an in-door view, a view *en*

robe de chambre, so to speak, of a man whose family is still living, savors of a certain bad taste, and the strained air of familiarity on Mr. Marcou's part ends by displeasing the reader the more, as it frequently appears to be an appearance of knowingness rather than a real knowledge, where minor events and personages are considered.

It offends most in the author's handling of certain persons who, having once been co-workers with Agassiz, had in one way or another ceased to be his friends. Human nature, even when in the wrong, demands something more than this off-hand contemptuous treatment, or else something less in the way of space taken up. The book, moreover, is written most disjointedly, is full of repetitions, and its comments on Agassiz's zoölogical philosophy are sadly beneath the level of the subject. But in spite of these defects—and they are truly grave ones—Mr. Marcou has evidently taken great pains with his volumes, and has achieved a result which probably comes quite near that at which he aims. In spite of his non-idealizing temperament, he genuinely admires his hero; and what with his facts, his broader appreciations, and all his little dabs and touches, the reader gets at last a picture of Agassiz which is both vivid and realistic, and awakens sympathetic admiration far more than any other kind of comment. Agassiz's personality was indeed so immense, his passions so overpowering, his enthusiasms so magnificent, his sociability and friendliness so great, that no other result was possible. His life, in all its phases, becomes inevitably a sort of heroic romance. Never was there so glorious a youth. At 20 he was a great collecting naturalist. At 22, whilst a student at Munich, he had published his folio describing Spix's collection of Brazilian fishes. At 23 he had begun work on his *Histoire Naturelle des Poissons*. At 26 his *Recherches sur les Poissons fossiles* began to appear. At 30 he had proved the 'Glacial Epoch' and received the Wollaston medal from the Geological Society—a unique honor for so young a man. Mr. Marcou catalogues 43 publications from his pen, many of them of the first order of magnitude, before his 31st year. And all this with no basis of support but his

absolute devotion to natural history and faith in his own powers. At Munich, with his naturalist student friends, "almost everything was enjoyed in common; work, pleasure, journeys, pipes, beer, purses, clothes, ideas, political and philosophical, or poetical, and even literary. In fact, it was a constant, enthusiastic, intellectual life, lived at high pressure, lacking in nothing; not even student-duels, and escapades of a more riotous nature after grand 'Kommers.' Agassiz enjoyed, among the students, the reputation of being the best fencer in the various students' clubs * * *. Strange to say, with an allowance of only \$250 a year, [he] managed constantly to keep in his pay an artist, Dinkel, to draw fossil and living fishes, and occasionally a second artist, Weber, to draw the Spix fishes and pieces of anatomy. They formed a sort of fraternal association. As Agassiz said, 'They were even poorer than I, and so we managed to get along together.' Their fare was certainly very simple, bread, cheese, beer and tobacco being the main articles. Imagine Agassiz, with his scanty allowance, providing for two artists, besides Carl Schimper and his younger brother, William Schimper. To be sure, Alexander Braun helped much also. But if we suppose that Braun got \$300 a year from his father, six young men, between the ages of twenty and twenty-five, had to live upon less than \$600 a year, out of which, also, they had to pay for their studies at the University and provide themselves with instruments and books and clothing. Agassiz got a little money from the 'Brazilian fishes' and some other writing, with which he purchased a microscope—a rather expensive instrument—and several books; and he received, as a gift, from Prof. Döllinger, a copy of the finely illustrated work on living fishes by the great French ichthyologist, Rondelet, of Montpelier. The editor Cotta sent him also a considerable number of expensive natural history books. * * * His room was used as lecture-room, assembly-hall, laboratory and museum. Some one was always coming or going. The half-dozen chairs were covered with books, piled one upon another, hardly one being left for use, and visitors were frequently obliged to remove books and put them on the floor; the bed also was used as

a seat, and as a receptacle for specimens, drawings and papers. According to Agassiz, the tobacco smoke was sometimes so thick that it might have been cut with a knife. Agassiz was the most prominent among the students. His acquaintance was courted by all. * * * He was considered a most amiable companion, never losing his temper, always smiling and apparently contented and happy. * * * There is no other example of such a rapid rise to great scientific reputation as Agassiz enjoyed in his thirtieth year. * * * His power of classifying fossils and his success in reducing to order thousands of specimens of fishes, a great many of which were perfect puzzles to everyone, were simply marvellous; and he worked at his herculean task as no man but a man of genius could have done.' (Vol. I., pp. 25, 113.)

Probably no one again will ever have as vast an acquaintance with living things as Agassiz possessed. No man will love Nature's forms more passionately. But biological science now expects more help from what the pedagogues call 'intensive' than from 'extensive' study, and her progress will for the present probably consist more in the unravelling of causes and conditions than in the description of new surface facts. Agassiz is the last of the type of great naturalists who took the individual forms of Nature at their simple surface value as living wholes. Causal laws have their nobility of outlook too, but it is of more abstract and sadder sort. 'Die Form ist zerbrochen, von Aussen herein,' we may say with the poet, when we come to deal with recent speculative biology; and those thoughts of God that Agassiz conceived himself to read off so easily were no doubt in form at least more like the real thoughts of God, in being intuitions of fully concrete facts, than are those poor naked forces and processes and logical elements of things with which our later science deals. Some day our descendants may get round to that higher way of looking at Nature again. Meanwhile from this book, as from every possible book about Agassiz, there floats up a breath as of the morning of life, that makes defects of taste and small in accuracies seem of little account. We recommend it therefore to our readers cordially enough.

Fear. ANGELO MOSSO. Translated from the fifth edition of the Italian by E. Lough and F. Kiesow. London, New York and Bombay, Longmans, Green & Co. 1896. Pp. 278.

Prof. Mosso is one of the most eminent of modern physiologists, and he is an Italian. This book bears ample witness to both facts. It is largely occupied with descriptions of the author's ingenious experiments on the cerebral blood-supply, and is written with naïve openness, eloquence and assurance that read more oddly in the English translation than in the original Italian.

The book not only describes the emotions, but also expresses them and appeals to them. It contains graphic descriptions of convivial feasts and death-bed scenes, even of a syphilitic woman and of a head cut off from the body. We are told of the author's feelings at his mother's grave and on which side of the face his sister blushes. The book is expressly intended for the general public, but will probably, in the Anglo-Saxon race at least, contribute less to its instruction than to the morbid appetite already sufficiently fed by the daily newspapers.

The first half of the book discusses chiefly the functions of the brain and spinal cord, and more especially the relation of the circulation of the blood to emotional disturbances. It is well known that we owe to Prof. Mosso the method of measuring the decrease in the volume of the extremities of the body due to congestion of the brain when it is excited by mental activity, the balance showing the movement of blood to the brain, and many other important investigations on cerebral circulation. Mosso's work in this field is of much value and originality, and it is an advantage to have it accessible in English, even though the method of presentation is not very systematic nor scientific.

The second half of the book is concerned chiefly with the expression of the emotions, not being confined exclusively to fear. Mosso argues against the view that the expression of the emotions must of necessity be useful to the individual. As the translation makes him say 'Spencer and Darwin were not physiologists enough.' It is undoubtedly true that certain expressions

of the emotions are pathological. Trembling, as an effect of fright, is probably no more useful to the individual than *paralysis agitans*. There are evident limits to the adaptability of the organism. The nervous system best suited to respond to ordinary stimuli may and does fail in the presence of unusual conditions. Mosso does not accept Mantegazza's extraordinary theory that a frightened animal trembles to keep its blood warm, but he holds that this is the reason why its hair stands on end!

The psychology in the book is not such as to warrant serious criticism. Mosso writes:

"We imagine that the impressions of the external world form a current which penetrates the nerves, and without either abatement or check, diffuses and transforms itself in the centers, finally reappearing in the sublime form of the idea; this is the notion of the soul held by the philosophers of remote antiquity; this is the base of modern psychology."

Indeed, the book does not appear quite contemporary; there is no discussion of the relation between pain and sensation, nor of the James-Lange theory of emotions, according to which the expression is the cause of the emotion and not conversely. The heredity of acquired characters is taken as a matter of course. We are told "civilization has remodeled our nerve-centers; there is a culture which heredity transmits to the brains of our children."

The reader who looks for an index will find in its place a twenty-four page catalogue of Messrs. Longmans, Green & Co.'s publications.

J. MCKEEN CATTELL.

Naturwissenschaftliche Einführung in die Bakteriologie: By FERDINAND HUEPPE, University of Prague. 268 pp. C. W. Kheidel, Wiesbaden, Pub.

Books upon bacteriological technique have been somewhat common in recent years but nothing has hitherto appeared, which, leaving out laboratory methods and systematic details, gives a summary of the important discoveries of modern bacteriology. The reputation of the author of the present work as one of the leaders in modern bacteriology is a sufficient guarantee of its value from a scientific standpoint, and the subjects treated are a sufficient guarantee of its interest. To one who wishes to know what bacteriology has accomplished and what prob-